COSSOR

DOUBLE BEAM

OSCILLOGRAPH

MODEL 1038

INSTRUCTIONS FOR USE

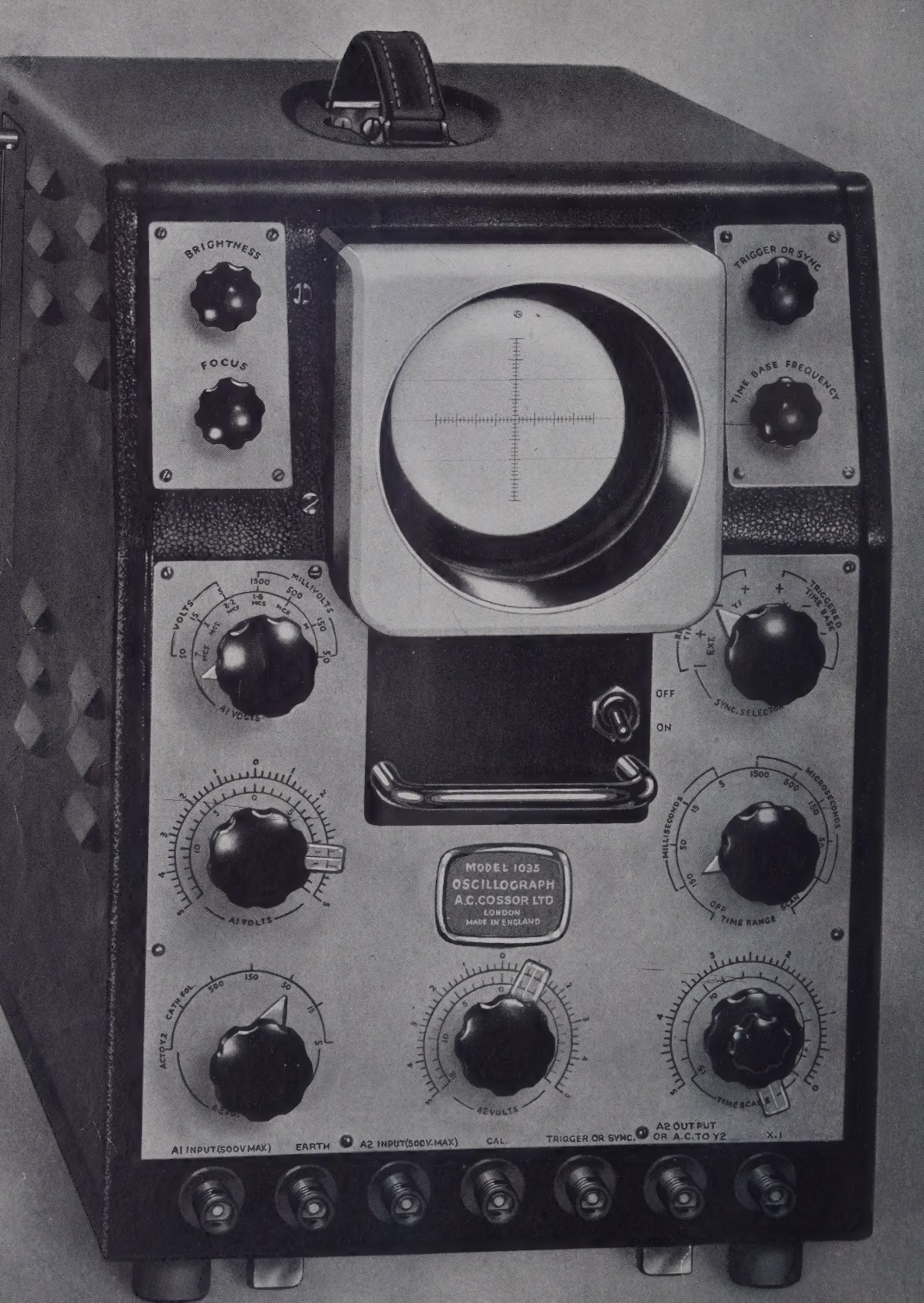
LOSSON
OBSTETRICIAN

CONTENTS

	Page
SPECIFICATION	5
PRESENTATION	6
TUBE AND AMPLIFIER CONTROLS	6
A1 AMPLIFIER	6
A2 AMPLIFIER	8
TIME BASE AND X SHIFT	8
TEST WAVEFORM VOLTAGE ("CAL.")	8
GRATICULE	9
POWER SUPPLIES	9
THERMAL CUT-OUT, FUSES AND MAINS SELECTOR	9
TUBE CONNECTIONS, AMPLIFIER AND T.B. OUTPUT	9
TERMINALS	10
TUBE MOUNTING AND BEAM BRIGHTNESS ADJUSTMENT	10
VIEWING HOOD	11
TILTING DEVICE	11
OPERATION	11
MODEL 1428 OSCILLOGRAPH CAMERA	13
CONSTRUCTION	14
OPERATION	15
CAMERA SPECIFICATION	15
MODEL 1431 MOTOR DRIVE ATTACHMENT	16
SPECIFICATION, FILM SPEEDS AND WEIGHT	16
TROLLEY MODEL 1050	18
SPARES AND SERVICE	20
REPLACEMENT PARTS LIST	21
CIRCUIT COMPONENT VALUES	22/23

ILLUSTRATIONS

MODEL 1035 OSCILLOGRAPH FRONT PANEL	4
MODEL 1035 OSCILLOGRAPH INTERIOR	7
MODEL 1428 OSCILLOGRAPH CAMERA	13
MODEL 1431 MOTOR DRIVE ATTACHMENT	16
CAMERA AND MOTOR DRIVE FITTED TO OSCILLOGRAPH	17
TROLLEY MODEL 1050	18/19
CIRCUIT DIAGRAM	Inset


BRIGHTNESS
FOCUS
TRIGGER OR SYNC
TIME BASE FREQUENCY
MILLIVOLTS
VOLTS
A1 VOLTS
TRIGGERED TIME BASE
EXT.
SYNC. SELECTOR
OFF
ON
MILLISECONDS
MICROSECONDS
OFF
TIME RANGE
MODEL 1035
OSCILLOGRAPH
A.C.COSSOR LTD
LONDON
MADE IN ENGLAND
A2 VOLTS
TIME CAL.
A1 INPUT (500V MAX.)
EARTH
A2 INPUT (500V. MAX.)
CAL.
TRIGGER OR SYNC.
A2 OUTPUT OR A.C. TO Y2
X.1

COSSOR

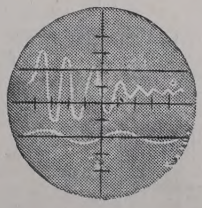
Model 1035

Double Beam Oscillograph

The modern Cathode Ray Oscillograph has become an indispensable tool not only for the research and development engineer, but increasingly so for the test and production specialist. Its unique characteristics make possible an ever increasing number of applications, finding solutions for problems in such diverse fields of science and industry as Biology, Ballistics, Medicine, Electrical, Mechanical and Marine Engineering, Mining, etc.

The Cossor Company, who pioneered the development and engineering of cathode ray tubes, oscillographs and associated equipment, have a unique record of achievement and experience in this branch of electronics. This design experience has been utilised to the full in the production of the new Cossor Model 1035 Double Beam Oscillograph.

The facilities offered by this instrument are such as to create for it a wider field of applications than any other transportable oscillograph.



The Reference Number of this publication is ***TP132***

COSSOR INSTRUMENTS LIMITED
(THE INSTRUMENT COMPANY OF THE COSSOR GROUP)
COSSOR HOUSE · HIGHBURY GROVE · LONDON, N.5
Telephone : CANonbury 1234 (33 lines).
Telegrams : AMPLIFIERS, NORPHONE, LONDON
Cables : AMPLIFIERS, LONDON
Codes : " BENTLEY'S SECOND "
TP132/1/56/1.0
Printed in England.

SPECIFICATION

POWER RATING

A.C. Mains Voltage—105 to 115, 120 to 130, 200 to 215, 216 to 234, 235 to 255.
A.C. Mains Frequency—50 to 100 cycles.
Power Consumption—170 watts (approx.).
Tube H.T. supply 2,000 volts, Amplifiers 450 volts, Time Base 370 volts.

DIMENSIONS

Height, including feet	16½ ins.	419 mm.
Width	11½ ins.	292 mm.
Length	19¾ ins.	501 mm.
Front handle and knobs, extra	2 ins.	50 mm.
Weight	63 lbs.	28.5 kg.

CATHODE RAY TUBE

Y sensitivity direct to tube 675/V ± 8% 3.0 volts per mm. D.C.
X sensitivity direct to tube 800/V ± 8% 2.5 volts per mm. D.C.
Output of both Amplifiers, Time Base and direct connections to Tube Plates and Modulator Circuits are available at the side of the instrument.

TIME BASE

Repetitive, triggered or single stroke operation.
Positive or negative sync. and trigger by switch control.
Directly calibrated time scale with 9 ranges, as follows : (Accuracy ± 10%)

150 milliseconds	1,500 microseconds
50 ,,	500 ,,
15 ,,	150 ,,
5 ,,	50 ,,
	15 ,,

Time Base volts available at high impedance at X1 terminal. Switch positions provided for EXT. T.B. and Time Base "OFF." Flyback suppressed.

SYNCHRONISATION AND TRIGGER

Switch selection for positive or negative sync. and trigger from external source or internally from Y1 Amplifier.

A1 AMPLIFIER

3 valves.
Directly calibrated voltage scale with 7 ranges as follows : (Accuracy ± 15%)

VOLTS RANGE	GAIN	FREQUENCY RESPONSE 15% DOWN	50% DOWN
50 volts	3 ...	7.0 Mcs. ...	10.0 Mcs.
15 volts	10 ...	3.0 Mcs. ...	4.5 Mcs.
5 volts	30 ...	2.2 Mcs. ...	2.8 Mcs.
1,500 millivolts	100 ...	1.6 Mcs. ...	2.0 Mcs.
500 do.	300 ...	1.0 Mcs. ...	1.4 Mcs.
150 do.	1,000 ...	150 Kcs. ...	500 Kcs.
50 do.	3,000 ...	60 Kcs. ...	250 Kcs.

L.F. Response down to 20 c.p.s.
Maximum Input Volts, 500 D.C.
Input Impedance, 2 megohms. Input Capacity, 20 pF.

A2 AMPLIFIER

Single valve.
Directly calibrated voltage scale with 5 ranges (Accuracy ± 15%).
500, 150, 50, 15 and 5 volts.
Frequency Response 20 c.p.s. to 100 Kcs.
Output available at terminal on front panel.
Cathode Follower facilities for external use.
A.C. connection to tube plate via terminal on front panel.
Maximum input volts, 500 D.C.
Input impedance, 0.2 megohms.
Input capacity, 35 pF.

TEST WAVEFORM VOLTAGE ("CAL.")

50 volts peak to peak, nominal.

PRESENTATION

The Model 1035 Oscillograph is business-like and attractive in appearance and finished in durable Black " leatherette " enamel. The front panel Escutcheons and Viewing Hood provide the necessary contrast in light colour and exposed metal parts are chromium-plated. A leather carrying handle at the top of the Instrument, folding flat when not in use, is easily gripped by the provision of ample hand-room in the dished case of the Oscillograph.

The case is a light-gauge aluminium shell forming a top, sides and back and it is secured to the main structure by four screws in its back. To remove the case, withdraw the fixing screws, grip the rear between the palms of the hands, lift slightly, then retract it from the guide-channels in the bottom tray.

TUBE AND AMPLIFIER CONTROLS

The four inclined controls mounted at the top of the front panel are—on the left—for the adjustment of the brightness and focus of the tube trace ; and—on the right—for the variation of the amplitude of the synchronising pulse to the time base (" TRIGGER OR SYNC."), and for the exact adjustment of the time base repetition frequency (TIME BASE FREQUENCY ").

The two dials to the left of the main escutcheon designated "A1 VOLTS RANGE " and " A1 VOLTS " are associated with the A1 amplifier controls. The first, acting as a stepped sensitivity selector will preset the gain of the amplifier in seven ranges from 50 volts with a 7 Mcs. bandwidth to the high gain position marked 50 millivolts where the bandwidth is 60 Kcs. The second, " A1 VOLTS," is a Y shift control and calibrated with two concentric arcs, the outer marked 5-0-5 is read when the gain selector switch is set at 50 volts and its sub-multiples, and the inner, 15-0-15 when the 15 volt range (and sub-multiples) is in use. A worked example (under " Operation ") will help to show the correct use of these controls.

The "A2 VOLTS RANGE " switch and its associated control "A2 VOLTS " (at the bottom of the panel) are similar to the Y1 controls and enable measurements to be made on the signal applied to the second beam. The two positions of the " A2 VOLTS RANGE " switch marked " AC TO Y2 " and " CATH. FOL." are to connect, in turn, the terminal marked " A2 OUTPUT OR A.C. TO Y2 " respectively to the Y2 plate (through a ·1μF condenser and 1 megohm leak to earth) and to the cathode-follower output of the A2 amplifier.

A1 AMPLIFIER

The amplifier comprises an input valve a driver and a cathode-follower output using negative feedback as a means of gain control. Signals to the Y1 Plate normally pass through the amplifier although direct connection to the plate is possible at the side of the instrument. Measurement of the Y1 signal may be made by a directly calibrated shift control used in conjunction with a range switch. This switch varies the amplifier gain in ratios of 10 and 3 and allows a definite frequency bandwidth to be allocated to each setting. The calibration accuracy is ± 15% and amplifier bandwidths stated are for a 15% fall in frequency response.

The maximum input voltage to the Amplifier must not exceed 500.

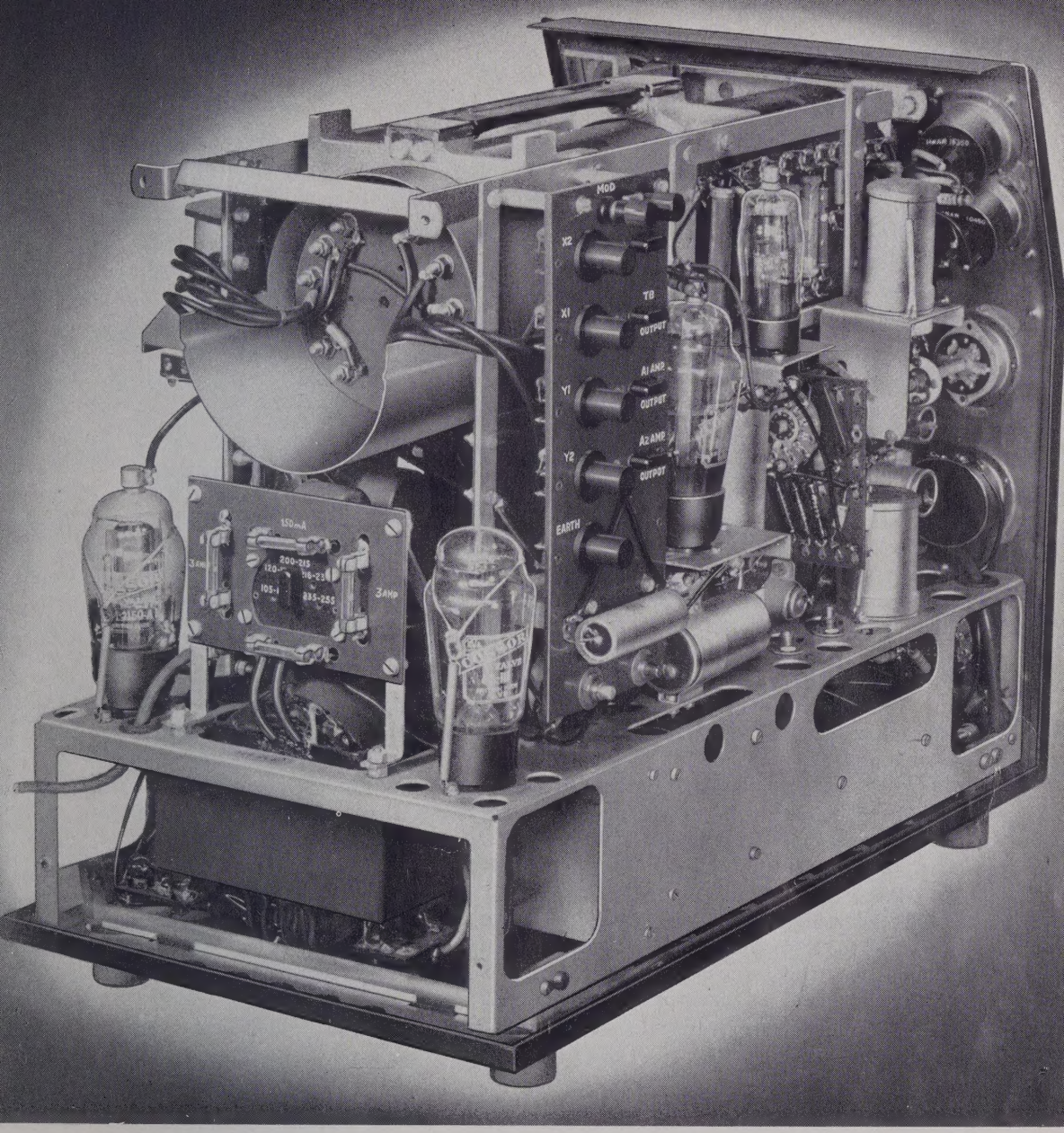


Illustration shows the interior of Model 1035 Double Beam Oscillograph with cover removed. The Tube Connections and the Amplifier and Time Base Output terminals can be seen, as well as the Fuses and Mains Selector Links. The leather carrying handgrip is not mounted to the outer dust cover but directly to the chassis assembly which thus takes the full weight when the instrument is lifted.

A2 AMPLIFIER

The A2 Amplifier is a single-valve circuit with a frequency-compensated input attenuator providing five ranges of input sensitivity from 500-0-500 volts to 5-0-5 volts.

Measurement of input voltage is made by a calibrated shift control as with the A1 amplifier.

Frequency response : 20 c.p.s. to 100 Kcs. $\pm$ 15%.

Maximum input voltage to the amplifier must not exceed 500.

TIME BASE AND X SHIFT

The " SYNC. SELECTOR " control on the right of the operating panel is an eight-position switch arranged in two groups of four : those to the left of centre operating during repetitive conditions of the time base and those to the right when the time base scan is externally triggered. In the repetitive condition the switch selects the polarity of the synchronising signal derived either from an external source (" EXT ") or from the internal amplifier (" Y1 "). The external synchronising signal is fed to the time base via terminal " TRIGGER OR SYNC." and " EARTH." When in the triggered position the time base scan is initiated by a signal fed to " TRIGGER OR SYNC." and " EARTH " terminals and again selection of the sign of the sync. pulse—whether external or internal—is arranged for.

Immediately under the " SYNC. SELECTOR " switch is the " TIME RANGE " control which presets the time base to any of nine basic traverse speeds. This switch will allow a variation of spot traverse speed from 150 milliseconds to 15 microseconds. On all ranges the spot fly back is suppressed.

In the fully anti-clock position of this switch the time base is inoperative and the X1 plate is connected to chassis. When set at " EXT. SCAN " an external time base may be connected to the Instrument between the " X1 " and " EARTH " terminals.

Below the " TIME RANGE " is a tandem control fitted with two concentric knobs and designated " TIME SCALE." The smaller knob controls the X shift and positions the trace horizontally : the larger is fitted with a transparent cursor and in conjunction with its associated scales (calibrated 0-15 and 0-5), measures Time. An example is shown under paragraph " Operation."

The remaining operational item is the " ON-OFF " switch located above the front panel lifting handle.

TEST WAVEFORM VOLTAGE ("CAL.")

A sinusoidal test waveform is available at the " CAL " terminal and its voltage is dependent upon the instantaneous value of the mains input to the Instrument. This test waveform measures 50 volts peak-to-peak when the transformer primary volts are 110, 125, 207½, 225 or 245, i.e. the mean of the mains input voltage ranges. The small notches appearing on the sinusoid can be ignored and are caused by an instantaneous voltage change due to the loading (and unloading) of the transformer by the full-wave H.T. Rectifier.

GRATICULE

The measuring graticule is a circular transparent Perspex disc, $\frac{3}{16}$ in. thick and engraved co-incidently on both its faces with 8 cm. intersecting horizontal and vertical datum lines. Each is calibrated in centimetres and sub-divided into units of 2 millimetres. The graticule abuts the Tube face and is located between a machined seating in the bezel casting and the viewing hood. When mounted it is, however, free to rotate and a small pin has been provided at its periphery so that, with a finger and thumb, its rotation is simplified.

With the flat screen Tube, measurement accuracy is uniform over the entire screen surface, parallax errors have been eliminated by double engraving and the thickness of the graticule precludes any possibility of mechanical distortion.

POWER SUPPLIES

The instrument is designed to operate from the standard A.C. Mains voltages of frequencies between 50 and 100 c.p.s.

The 450V. Positive Rail feeding the Time Base and Amplifiers is supplied from a full-wave rectifier while the 2000V. Negative Rail is fed from a half-wave rectifier and electronically smoothed.

THERMAL CUTOUT, FUSES AND MAINS SELECTOR

The four fuses and mains selector link are situated behind the trap-door in the rear of the Case. Before operating the Oscillograph care must be taken to set the selector link to the correct mains tapping of the five provided. A simple thermal safety device does, however, safeguard the transformer in the event of an inadvertent application of too high a voltage by breaking the primary circuit mechanically. An " S " shaped spring link in series with the primary winding is secured with low melting point solder which—fuzing at about 100°C.—allows the link to break the circuit as the transformer overheats. When re-fixing this device only LOW MELTING POINT solder may be used (Fry's No. 11).

TUBE CONNECTIONS, AMPLIFIER AND T.B. OUTPUT

Access to the tube plates, tube modulator and the output of the Amplifiers and Time Base can be gained through the trap door at the side of the Instrument. Links are fitted to this panel so that the tube Plates and Modulator are connected either to the internal Instrument circuits or to the row of terminals to the left of the panel. In this latter condition the Cathode Ray Tube may be fed from amplifiers and a time base completely external to the Oscillograph. The plate terminals " X2," " X1," " Y1 " and " Y2 " are returned to chassis internally through one megohm resistors. When making connections to these terminals, and especially to the Modulator (" Mod ") the Instrument *MUST* first be dis-connected from the Mains supply, or a very serious shock to the operator may result.

TERMINALS

The terminals, of patented design, allow the connection of two or more plain leads (under spring pressure) and, independently but simultaneously, a connection by a " crocodile " clip.

To the left of the row is the " A1 INPUT " for connection to the A1 amplifier. The " EARTH " terminal is the common return of all the instrument circuits to chassis. " A2 INPUT " gives access to the A2 amplifier.

The " TRIGGER OR SYNC." is for the injection of the synchronising voltage when the " SYNC. SELECTOR " switch is set at REPETITIVE " EXT." and for the triggering pulse when set at TRIGGERED " EXT." A maximum of a 1,000 volts D.C. may be applied at this point.

The terminal marked " A2 OUTPUT OR A.C. TO Y2 " is normally connected to the high impedance output of the A2 amplifier, but when the " A2 VOLTS RANGE " switch is set at " CATH. FOL." a low impedance cathode follower output of this amplifier is instead presented. In the " A.C. TO Y2 " position of the " A2 VOLTS RANGE " switch, the terminal is disconnected from the A2 amplifier and connected —via a condenser and leak—direct to the Y2 tube plate. In this condition a maximum output of 500 volts is permitted.

At the " X1 TERMINAL " there is available the saw-tooth voltage of the internal time base : when the " TIME RANGE " switch is set at " EXT. SCAN " however, the terminal is connected to the X1 tube plate and an external time base may be fed to this terminal and " EARTH."

TUBE MOUNTING AND BEAM BRIGHTNESS ADJUSTMENT

The cathode ray tube is mounted inside a mu-metal screen and supported at the front by a felt ring and at the rear by the eleven-pin socket. To remove the tube, first remove the instrument cover. Slacken the nut gripping the upper end of an L-shaped bracket affixed to the centre of the tube socket and draw the entire assembly of tube and socket approximately $\frac{1}{2}$ in. rearwards. Holding the neck of the tube near the base, pull off the socket and transfer the upper retaining hook from the socket to the edge of the tube base. By tilting back the socket, similarly transfer the lower retaining hook. The holder can now be moved downwards and the tube withdrawn from the rear.

The instrument leaves the works embodying a magnetic beam brightness adjusting device and is correctly set for equality of beam currents. The device is incorporated to correct any possible slight de-centralisation of the electron beam as it comes under the influence of the splitter plate and thus provides two spots of equal intensity on the screen. At the same time it offers to the user a means of equalising the brightness of the beams when the application of a signal of higher frequency and/or amplitude to one of them, results in a longer excursion of the spot and a consequent diminution in its brightness.

The device consists of a brass felt-lined clamping band in two similar halves

from which extend symmetrically two holders, each housing a compensating magnet. The assembly is clamped around the neck of the tube with the magnets pointing towards its base and positioned, radially, so that one of them lies between the tube-base contacts marked " A2 " and " Y2 ". The magnets are located with their like poles facing the same direction and if removed from their holders care must be taken to replace them correctly. The beam brightness adjustment procedure is as follows:

Remove the case and withdraw the four screws securing the aluminium casting on which the leather carrying handle is mounted. Access is now possible to an arcuate cover in the mu-metal screen. Remove this and slacken off the two clamp screws of the magnetic adjuster. With the instrument switched on and the BRIGHTNESS control set so that the two traces are just visible, carefully slide the magnet assembly up and down the tube neck until the beams are of equal brightness. Replace the arcuate cover in the mu-metal screen and re-check.

Should no further adjustments be necessary, tighten the clamp screws, replace handle casting and case. If it is desired to correct for lowered beam brightness resulting from a greater trace length of one beam, the procedure already outlined is adopted, but in this circumstance the brightness adjustment is made with the appropriate signals applied to the inputs of the amplifiers.

VIEWING HOOD

The cast aluminium Viewing Hood serves not only to locate the graticule but to secure a shielding of the Tube face from unwanted illumination. In the rear face of the Hood, a raised annulus has been machined so that, when mated to the Tube bezel casting, a light-tight joint is assured.

It is held in position by four split pins registering with corresponding sockets in the bezel casting and easily removed by gripping its two sides and exerting a *symmetrical* pull.

TILTING DEVICE

When this Oscillograph is standing on an average Laboratory bench, no difficulty will be experienced in reading the calibrated dials but it sometimes happens —particularly in cases where the Instrument is used for checks-on-location—that it must be operated at low eye-levels. A tilting device has, consequently, been provided so that the Front Panel may be inclined to a more convenient viewing angle.

" U "-shaped in appearance, it is fitted under the bottom tray of the Oscillograph and secured, when not in use, by two spring clips. To operate, raise the front of the instrument by means of the chromium handle on the panel, release the tilting device from its clips and pull it forward to its maximum extent.

OPERATION

To clarify the operation of the Instrument a worked example is shown.

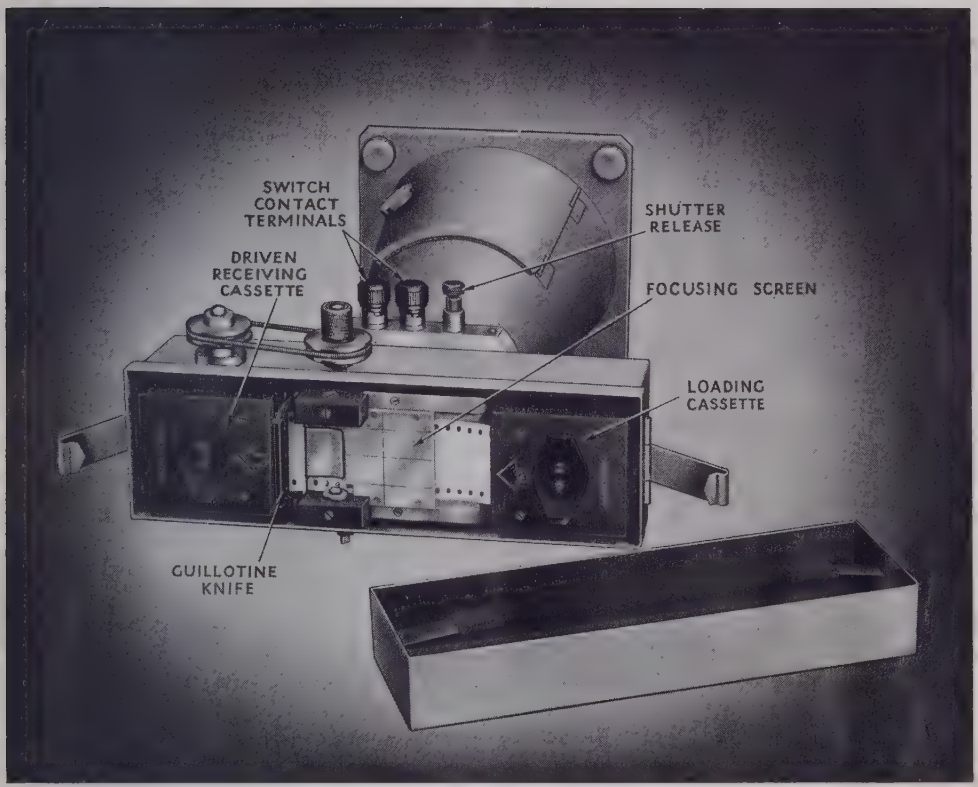
It is required to find the frequency and amplitude of a signal from, say a low frequency oscillator. The Oscillograph is switched on and allowed to warm up. The controls " Trigger or Sync." and " Time Base Frequency," mounted on the right of the inclined portion of the front panel, and the X shift control which forms the front portion of the tandem control " Time Scale " are set at, roughly, the mid-point of their total travel. Set the " Sync. Selector " switch in the Repetitive

condition to " + Y1 " and the " TIME RANGE " Control at the lowest spot traverse speed of 150 milliseconds. The " A1 VOLTS " control is set at its centre zero. The brightness and focus of the trace on the screen can be adjusted by their appropriate controls at the top left side of the operating panel. Since measurements are being made on a signal fed to the Y1 beam only, the second beam may, to avoid confusion, be moved off the screen by means of the " A2 VOLTS " control.

The output of the test oscillator is connected to the " A1 INPUT " and " EARTH " terminals of the Instrument and the trace will expand into a band of light, due to the modulation upon it. For the convenient measurement of this voltage an amplitude of, say, three centimetres is desirable, so the gain of the A1 amplifier is increased, if necessary, by rotating the " A1 VOLTS RANGE " switch clockwise to a higher gain position. In our example let it be assumed that this amplitude is obtained when the gain switch is at its 5 volt setting. To measure, then, the voltage of the applied signal bring the top edge of the luminous band to the horizontal centre line of the graticule by using the " A1 VOLTS " control, and read the outer (0-5) scale. Let this value be 1·5. Now shift the trace so that its lower edge is coincident with the datum line and note the scale reading on the other side of the " A1 VOLTS " centre zero ; this may read 2·5. The unknown voltage is, therefore, 4, being the summation of the two readings on either side of the centre zero.

To measure the frequency of the oscillator, the scanning speed of the spot must first be increased in order to resolve the trace into a stationary oscillogram of the waveform. The " TIME RANGE " switch, is therefore, set to a higher traverse speed, say, 15 milliseconds, and in conjunction with the " TIME BASE FREQUENCY " control, the trace is gradually brought to rest. If the oscillogram shows any sign of " hunting " it can be locked into a perfectly stationary picture by applying an internal synchronising signal to the time base by operation of the " TRIGGER OR SYNC." control.

Let it be assumed that we now have on the screen a three-cycle oscillogram (a convenient number) of the unknown signal. With the " TIME SCALE " cursor set at exactly zero, operate the front knob of the tandem combination—the X shift—until the peak of one of the cycles of the waveform is coincident with the vertical centre line of the graticule. Now, using the rear calibrated control advance the trace so that the crest of the next wave cuts the centre line and, using the 0-15 scale, read the figure under the cursor. Let this be 5. Since the " TIME RANGE " switch is set at 15 milliseconds, then this reading is 5 milliseconds and is the time interval of a cycle of the applied waveform. By substitution in the formula $f = 1/T$—where f = frequency in cycles/second and T = the time interval in seconds—we can re-write $f = 1/\cdot 005$. The unknown frequency is therefore 200 cycles per second.



MODEL 1428 OSCILLOGRAPH CAMERA

The Camera has been specially developed for use with the Cossor Portable Oscillographs types 1035 and 1049, using the new flat screen 4″ single or double beam Cathode Ray Tube. It provides the simplest means of recording oscillograph pictures, either by taking single shots of a stationary waveform, whether synchronised to the Oscillograph recurrent Time Base or on a single stroke traverse or, alternatively, it can be used for continuous records of non-recurrent waveforms and slow transients by the moving film method.

The instrument is designed to use standard perforated 35 mm. stock in rolls of 25 feet. Any negative or positive film may be used, the type and speed of the emulsion depending upon the writing speed of the Cathode Ray Tube spot and the contrast required of the record. For direct Positives—where no enlargement or duplication is required—Oscillograph Recording Paper may be used, its photographic speed comparing favourably with the fastest panchromatic oscillograph film when using a blue screen tube.

The Receiving Cassette will accommodate the full 25 feet of stock from the Loading Cassette either frame by frame or continuously—where the Camera is motor-driven—up to a maximum speed of 5 feet/sec. Abrasion of the recording area

of the emulsion is avoided by suitable design of the film-gate. The Cassettes may be placed in or removed from the Camera in daylight although, of course, the Loading Cassette must be charged in a dark-room.

A fixed-focus lens of aperture F/3.5 is fitted as standard giving a reduction ratio of 2.6 : 1. A maximum image size of 25 mm. is, therefore, obtained with a 6.5 cm. trace on the Cathode Ray Tube screen. The single-bladed shutter is push-button operated for " bulb " exposures and by rotating the button a few degrees in either direction when depressed, it can be locked open for moving film records or " time " exposures. An Event or Beam-triggering switch, incorporated in the shutter mechanism, is arranged to close during the shutter opening period and leads to this are brought out to two terminals located next the shutter button.

CONSTRUCTION

The Camera is of sheet-metal construction. The rectangular body measures $8\frac{1}{2}$" long, $2\frac{5}{8}$" wide and $3\frac{1}{4}$" deep and is mounted at the apex of a cone-shaped hood, through a cast aluminium member housing the lens, shutter and shutter-switch.

The base of the hood is formed by a second aluminium casting suitably shaped to mate exactly with the tube bezel castings of the Cossor Model 1035 and 1049 Oscillographs. The Camera locates with these Oscillograph bezels by means of two register pins and is clamped by knurled thumb-screws arranged diagonally on the hood base casting. An annular light trap is machined in this casting to prevent the entry of unwanted light on to the Tube face. The hood is provided with a large aperture window for viewing directly the Cathode Ray traces on the tube for alignment before recording. This window is sealed by an arcuate hinged trap-door which is clamped against light entry on to a sponge-rubber seating in compression.

The body of the Camera contains a main casting locating the driving sprockets and guide rollers, a guillotine knife for cutting off the exposed length of film and a plastic focal plane screen with engraved limit and centre lines for the direct viewing of the image prior to loading. The Cassettes are located on either side of the main casting within the Camera body and are instantly removed by pressure with the little finger through suitably light-trapped holes in the underside of the body.

The film driving spindle extends top and bottom from the body, the upper extension carrying a take-up driving pulley and a knurled thumb-screw for the manual operation of the Camera on single shots. The bottom extension is designed for coupling to the Cossor motor drive Attachment or to any other form of drive having a minimum torque of approximately $\frac{1}{2}$ lb. ft.

The Receiving Cassette is driven from the main spindle through a slipping spring belt and dog-clutch. Both Cassettes are held in position by pressure springs in the Camera body lid which is, in its turn, clamped to the body by means of two snap clips arranged at its ends. The Camera is finished in a high-grade grey enamel with fittings in dull chrome.

OPERATION

The Loading Cassette accepts standard 25 ft. rolls of perforated stock and is very simply loaded in the dark room by slipping the roll of film through the slotted light-trap into the magazine and replacing the lid. When inserted into the Camera the free end of the stock is led through the film gate by rotating the knurled thumb-screw in the direction of the engraved arrow and secured to the core of the take-up-spindle in the Receiving Cassette by the annular clamping spring provided. This loading operation fogs about 6" of the emulsion.

After replacing the lid of the Camera it is necessary to wind on this fogged portion by rotating the thumb-screw one and a half turns. For single exposures wind on the thumb-screw three quarters of a turn to ensure reasonable margins between frames.

To use the guillotine, the lid must be removed, but first give the spindle an extra half turn ($1\frac{1}{2}$ in all) to wind off the last exposure. After cutting, the Receiving Cassette may be removed and replaced by another.

Preliminary tests with the sensitised material used will determine the exposure and spot brightness required for an adequate record. As a rough guide, it may be said that an exposure of ·5 second, approximately, will yield successful results on fast film or paper when photographing one cycle, say, of a synchronised 50-cycle input where the amplitude of the tube trace is of the order of 6 cm. and of " comfortable " visual brightness. This assessment is valid for blue-trace photography. Where a green screen is used, increase the exposure by a factor of 2 or 3.

CAMERA SPECIFICATION

LENS	Aperture F/3.5.
SHUTTER	Single-bladed, push-button operated.
FILM DRIVE	Sprocket feed.
LENS REDUCTION RATIO	2.6 : 1.
MAX. SIZE OF RECORD ...	On Tube screen—6.5 cm. On film—25 mm.
SHUTTER SWITCH... ...	Switch contacts close during shutter opening period for Beam or Event triggering. Maximum switch rating 50 volts, 100 mA non-inductive.
FITTING	The Camera is located with Oscillograph tube bezel by two register pins and is clamped by two captive thumb-screws.
FOCUSING	The focus is adjusted and set at Works but can be re-adjusted by first slackening off lens set-screw in mount.
RECORDS	Single frame or continuous film with Motor Attachment.
FILM AND PAPER	Designed for use with 35 mm. perforated film or paper in 25-foot rolls. Specially "Perforated, emulsion inward and uncored" when ordering stock.
LOADING	The Camera is daylight-loaded after charging Loading Cassette in dark-room.
WEIGHT, Camera only, with loaded Cassettes.	$5\frac{1}{2}$ lbs. (2.5 kg.)

CAMERA DRIVE and TRANSFORMER/CAPACITOR UNITS

For many investigations it is convenient to lock the trace to be photographed with the electronic time base of the instrument and expose the film by a momentary opening of the bulb shutter. Where non-recurrent waveforms are to be photographed, however, or when a continuous recording is desired extending over some minutes, then some form of film drive becomes essential.

The Cossor Model 1431 Drive Unit provides such a drive and is arranged for film speeds as follows: (inches/second) .05, .1, .25, .5, 1, 2.5, 5, 10, 25. By the positive action of the drive engagement lever, the starting and stopping of the film is, for practical purposes, instantaneous.

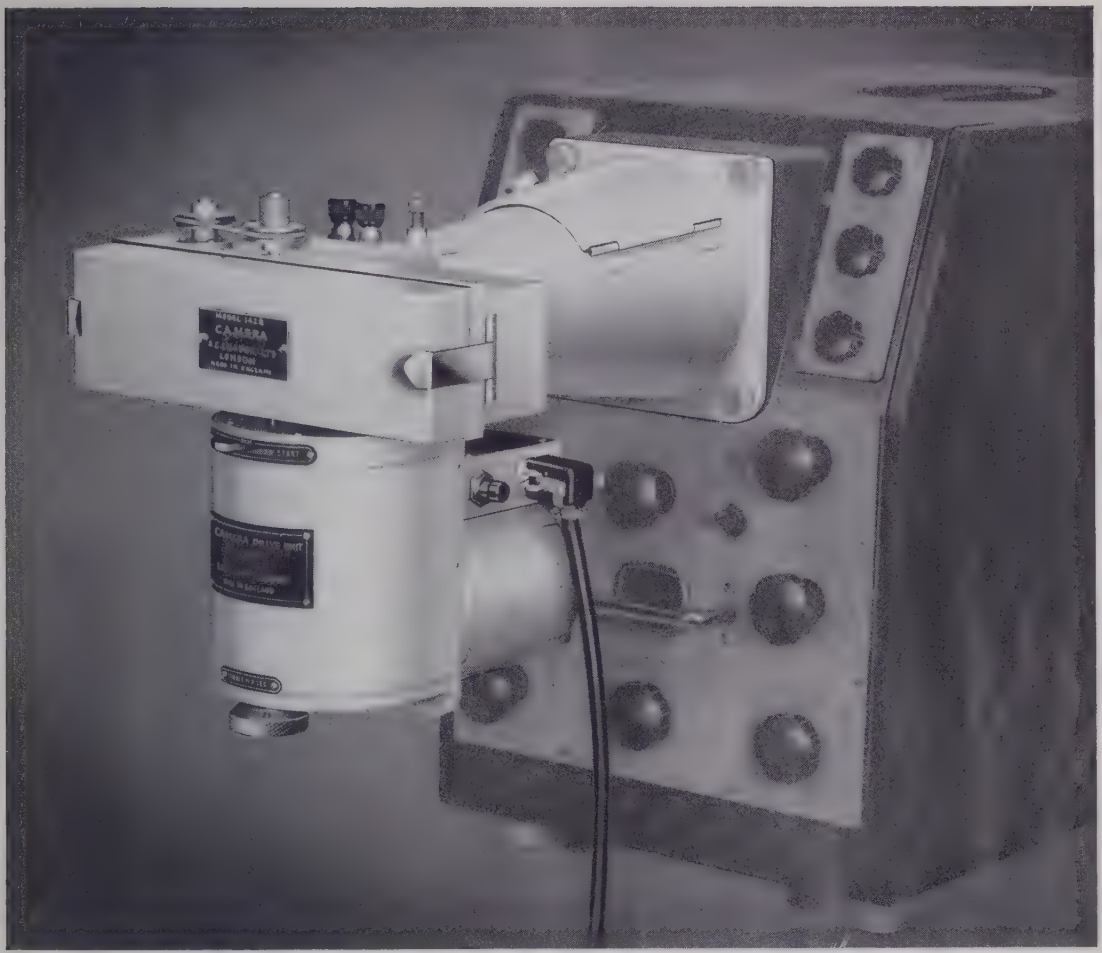
For short records development may be carried out in a dish by " see-sawing " as with a standard roll-film but where several feet have to be handled, it is almost essential to adopt some form of frame or drum processing technique.

Practically any contrasty developer is suitable but a metol-hydroquinone type is recommended for clean working. Normal development is complete after three minutes at 65°F. Thorough fixation and washing is essential to secure an absolutely permanent record.

SPECIFICATION. For single-phase A.C. Mains only, 110V, 200V, 225V, 250V, 50 cycles.

FILM SPEEDS	(Inches/second)	.05	.1	.25	.5	1	2.5	5	10	25
	(cm/sec)	.127	.254	.635	1.27	2.54	6.35	12.7	25.4	63.5

DIMENSIONS	(Camera Drive)	Height $5\frac{7}{8}$ in. (14.9 cm).	Width	$4\frac{5}{16}$ in. (11 cm).
		Depth $8\frac{1}{4}$ in. (21 cm).	Weight	8 lb. (3.63 kg).
	(Transformer/Capacitor)	Height 3 in. (7.62 cm).	Width	$4\frac{1}{4}$ in. (10.8 cm).
		Depth $4\frac{3}{8}$ in. (11.1 cm).	Weight	$3\frac{1}{4}$ lb. (1.48 kg).



CAMERA DRIVE UNIT MODEL 1431

Designed for use with the Cossor Cameras, Models 1428 and 1432, this drive unit embodies a capacitor motor of ample power, worm-coupled to a nine-speed gear box. Gear selection is effected by rotation of an engraved knurled knob and the film transit is started and stopped by a quick acting lever. Switching of the motor is by a " push-push " type control mounted to the gear box. The drive unit may be operated from single-phase A.C. supplies of 110V, 200V, 225V and 250V through an auto-transformer which, with the motor capacitor, is housed separately in a metal box and forms part of the mains lead to the unit.

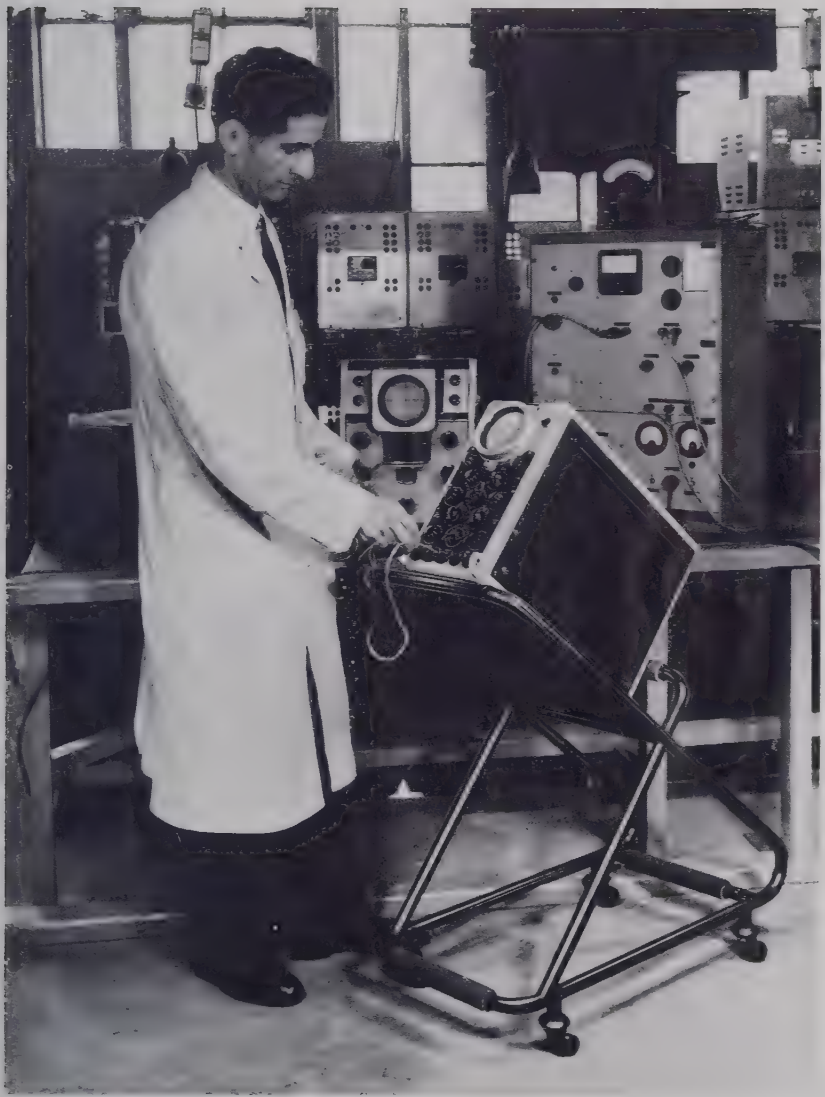
MODEL 1050A OSCILLOGRAPH TROLLEY

This Trolley provides an admirable stand for the Cossor Oscillographs, and enables them to be wheeled easily from one part of the Laboratory or Works to another.

The Oscillograph stands on a steel platform welded to the carriage, the angle of support assuring a comfortable viewing slant whether the Operator is seated or standing.

The four rubber-tyred swivel castors permit sideways as well as longitudinal movement of the Trolley which, of tubular welded-steel construction, is immensely strong, light and possesses a satisfactory lateral stability.

The equipment is finished in a semi-matt black stove enamel and weighs 20 lbs.



Trolley Model 1050A with Oscillograph mounted for use in laboratory

SPARES AND SERVICE

To assure the prompt despatch of Spare Parts, it is essential that the Order includes the Model No. of the instrument, the description of the Part or Parts, their Part No. and the quantity required. No further information is necessary.

Whilst every effort is made by Service Departments to maintain an adequate supply of Spares, a delay in despatch must usually be tolerated on those Parts not ordinarily expected to require replacement.

Where purchase of the Instrument has been made through a Cossor Stockist or Agent, all Service Enquiries and Orders must be routed direct to that Supplier.

Purchasers (within the United Kingdom) of Instruments DIRECT from Cossor Instruments Ltd. are asked to address their Service Enquiries and Orders to :—

Service Department,
A. C. Cossor Ltd.,
51 Calthorpe Street,
LONDON, W.C.1.
Telephone : TERminus 0077/8.

Purchasers (outside the United Kingdom) of Instruments DIRECT from Cossor Instruments Ltd. are asked to address their Service Enquiries and Orders to :—

Cossor Instruments Ltd.,
Cossor House,
Highbury Grove,
LONDON, N.5.
Telephone : CANonbury 1234.

ALL Technical Service Enquiries (i.e. requests for Technical Information) whether from Home or Overseas Purchasers, must be addressed to :—

Cossor Instruments Ltd.,
Cossor House,
Highbury Grove,
LONDON, N.5.

and in no circumstances to the Service Department of A. C. Cossor Ltd.

REPLACEMENT PARTS LIST

Valve Holders, Retainers, etc.:—

High Voltage 5 Pin	M.121516
Button Base B7G miniature	M.121520
Ceramic 9 Pin	M.121522
Octal International	M.121524
Valve Retaining Spring	M.122525
Valve Retainer	M.202503/2
Valve Retainer Hook	M.199500/2

Switches, Knobs, etc.:—

A1 Volts Range Switch (S1, S2) ...	MC.460011
A2 „ „ „ (S5, S6, S7, S8)	MC.460012
Time Range (S9, S10, S11)	M.153521
Sync. Selector (S12, S13, S14, S15, S16)	M.153522
Mains on/off	M.153525
Knob, large	MC.469004
„ large with centre hole ...	MC.469004/2
„ small	MC.469005
„ Switch	MC.469011
Cursor Transparent	M.125521
Pointer, White	M.125520

Cathode Ray Tube Assembly :—

Double Beam 4″ CRT	89D
Tube Base	MC.408057
„ „ Pins	M.138571
Magnet and Clamp Assembly	MC.416080
Magnet	M.191503
Mu Metal Screen	M.118580

Case Assembly :—

Case	MC.409039
Leather Carrying Handle	M.199572
„ „ „ Casting ...	M.147524/2
Viewing Hood	MC.408042
„ „ Studs	M.124622
Graticule	MC.416050
Escutcheons main	M.172524
„ top left	M.172523
„ top right	M.172523/2
Name Plate	M.173699
„ „ Bezel	M.172525
Tilting Member	MC.416045
„ „ Securing Clips ...	M.122533
Rubber Feet	M.164537
Terminals	MC.408035
„ Locking nut	M.166501

Miscellaneous :—

Side Panel Connector Plug	M.143503
'MOD' Terminal Link	M.138566
Voltage Change Plug	M.143503
'A1' Input Condenser Screening Can	M.118556
Fusible Connector	M.122514
Bottom Tray	MC.416044
Coupling (A1 Volts Range Switch) ...	M.199544
Fuse Clip	M.142665
Pilot Lamp Holder	M.164500/2

COSSOR Model 1035 Double Beam Oscillograph

CIRCUIT COMPONENT VALUES

Ref.	Value	Rating	Part No.
R1	8·2K ±20%	1 W	DR02/82220
R2	2·2K ±20%	½ W	DR08/22220
R3	82K ±10% or 20%	1 W	DR02/82310
R4	82K ±10% or 20%	1 W	Altern.
R5	82K ±10% or 20%	1 W	DR02/82320
R6	82K ±10% or 20%	1 W	
R7	1·5K ±20%	½ W	DR08/15220
R8	33K ±20%	2 W	DR01/33320
R9	68K ±20%	1 W	DR02/68320
R10	680K ±20%	½ W	DR08/68420
R14	10K ±10%	⅓ W	DR08/10310
R15	50K Colvern		M158520
R16	1 MΩ Preset	Morgan LH	KS92135/3
R17	2·2 MΩ ±20%	1 W	DR02/22520
R18	2·2 MΩ ±20%	1 W	DR02/22520
R19	82K ±10%	2 W	DR01/82310
R20	120K ±10%	½ W	DR08/12410
R21	470K ±20%	½ W	DR08/47420
R22	100K ±20%	2 W	DR01/10420
*R23	10K ±20%	½ W	DR08/10320
R24	50K—Triple Wound Pot com-		M158517
R25	50K—prising R24, R25 and R32		M158517
R26	82K ±5%	(VIT)	DR43/82305
R27	82K ±5%	(VIT)	DR43/82305
R28	27K ±20%	2 W	DR01/27320
R29	330 Ω ±20%	½ W	DR08/33120
R30	15K Morgan H		M158521/2
R31	82K ±10%	2 W	DR01/82310
R32	50K (See R24 and R25)		M158517
R33	1 MΩ ±20%	½ W	DR08/10520
R34	1 MΩ ±20%	½ W	DR08/10520
R35	100K Morgan H		M158521
R36	1 MΩ ±20%	½ W	DR08/10520
R37	1 MΩ ±20%	½ W	DR08/10520
R39	1 MΩ ±20%	½ W	DR08/10520
R40	2·2 MΩ ±20%	½ W	DR08/22520
R41	120 Ω ±20%	½ W	DR08/12120
R42	1 MΩ ±20%	½ W	DR08/10520
R43	2·2K ±20%	½ W	DR08/22220
R44	82K ±10%	2 W	DR01/82310
R45	47 Ω ±20%	½ W	DR08/47020
R46	120 Ω ±10%	½ W	DR08/12110
R47	3·9 MΩ ±20%	1 W	DR02/39520
R48	3·9 MΩ ±20%	1 W	DR02/39520
R49	22K ±20%	½ W	DR08/22320
R50	2·2 MΩ ±20%	½ W	DR08/22520
R51	82K ±10%	2 W	DR01/82310
R52	120 Ω ±20%	½ W	DR08/12120
R53	100K ±10%	1 W	DR02/10410
R54	330K ±20%	½ W	DR08/33410
R55	1 MΩ ±20%	½ W	DR08/10520
R58	1 MΩ Preset	Morgan LH	KS92135/3
R59	2·2 MΩ ±20%	1 W	DR02/22520
R60	2·2 MΩ ±20%	1 W	DR02/22520
R63	13·2K ±2%	½ W	M132510/10
R64	6·3K ±2%	½ W	M132510/9
R65	1·5K ±2%	½ W	M132510/8
R66	600 Ω ±2%	½ W	M132510/7
R67	150 Ω ±2%	½ W	M132510/6
* On some models 15KΩ		DR08/15320	

Ref.	Value	Rating	Part No.
R68	47 Ω ±2%	½ W	M132510/5
R69	18 Ω ±2%	½ W	M132510/11
R70	2 Ω ±2%	½ W	M132511
R71	470K ±20%	½ W	DR08/47420
R72	47K ±10%	2 W	DR01/47310
R73	3K ±5%	N.I. VIT.	M132508
R74	3K ±5%	N.I. VIT.	M132508
R75	47 Ω ±20%	½ W	DR08/47020
R76	120 Ω ±20%	½ W	DR08/12120
R77	200 Ω Colvern		M158520/3
R78	15K ±10%	2 W	DR01/15310
R79	15K ±10%	2 W	DR01/15310
R80	820K ±20%	½ W	DR08/82420
R81	47K ±10%	2 W	DR01/47310
R82	146K ±2%	½ W	M132510/32
R83	120 Ω ±20%	½ W	DR08/12120
R84	51K ±2%	½ W	M132510/4
R85	14·5K ±2%	½ W	M132510/3
R86	5·1K ±2%	½ W	M132510/2
R87	2·2K ±2%	½ W	M132510
R88	27K ±20%	½ W	DR08/27320
R89	2·7K ±20%	½ W	DR08/27220
R90	1·5K ±20%	½ W	DR08/15220
R91	1 MΩ ±20%	½ W	DR08/10520
R92	¼ MΩ Morgan LH		KS92135/6
R93	120 Ω ±20%	½ W	DR08/12120
R94	1 MΩ ±20%	½ W	DR08/10520
R95	330 Ω ±10%	½ W	DR08/33120
R96	¼ MΩ Morgan LH		KS92135/7
R98	470K ±20%	½ W	DR08/47420
R99	56K ±20%	½ W	DR08/56320
R100	27K ±10%	2 W	DR01/27310
R101	120 Ω ±20%	½ W	DR08/12120
R102	270 Ω ±10%	½ W	DR08/27110
R103	10K ±10%	½ W	DR08/10310
R104	10K ±10%	½ W	DR08/10310
R105	500 Ω Colvern		M158520/2
R106	270K ±10%	½ W	DR08/27410
R107	47K ±10%	1 W	DR02/47310
R108	1000 Ω ±20%	½ W	DR08/10220
R109	180K ±10%	½ W	DR08/18410
R110	22K ±10%	½ W	DR08/22310
R111	50K Colvern		M158520
R112	22K ±20%	½ W	DR08/22320
R113	56K ±20%	¼ W	DR08/56320
R114	¼ MΩ Morgan H		M158521/3
R115	47K ±20%	½ W	DR08/47320
R116	68K ±20%	½ W	DR08/68320
R117	4·7K ±10%	½ W	DR08/47210
R118	4·7K ±10%	½ W	DR08/47210
R119	2·2K ±10%	½ W	DR08/22210
R120	½ MΩ Morgan H		M158521/4
R121	2·2K Ω ±20%	½ W	DR08/22220
R122	5K Ω ±5%	30 W	M132508/2
R123	5K Ω ±5%	30 W	M132508/2
R124	330 Ω ±20%	½ W	DR08/33120
R125	470 Ω ±10%	⅛ W	DR08/47110
R126	15K Ω ±10%	2 W	DR01/15310
R127	15K Ω ±20%	½ W	DR08/15320

www.manualsplus.com
1003272

PRICE 4/- NETT